Population Change of Cerulean Warblers Estimated From the North American Breeding Bird Survey

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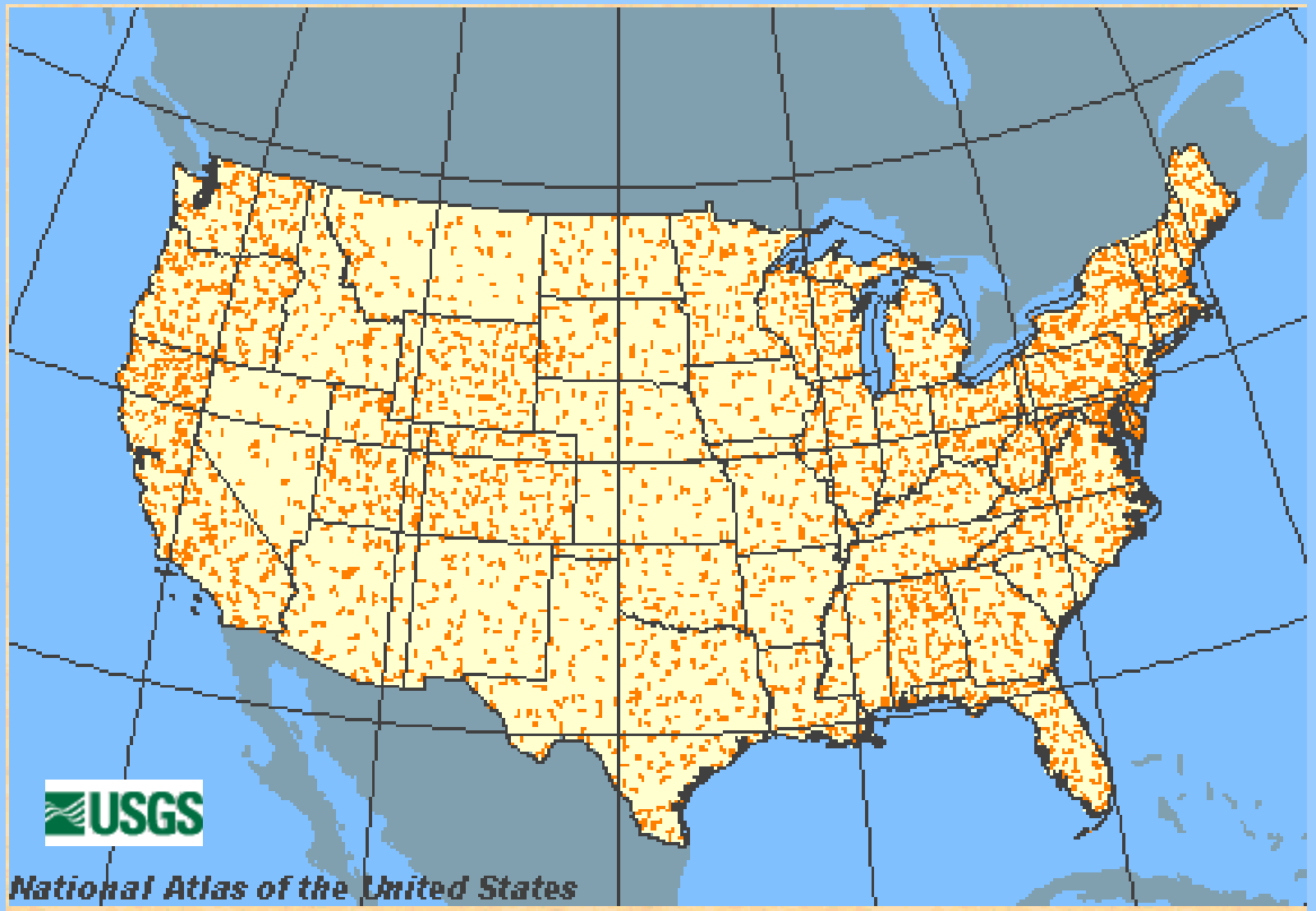
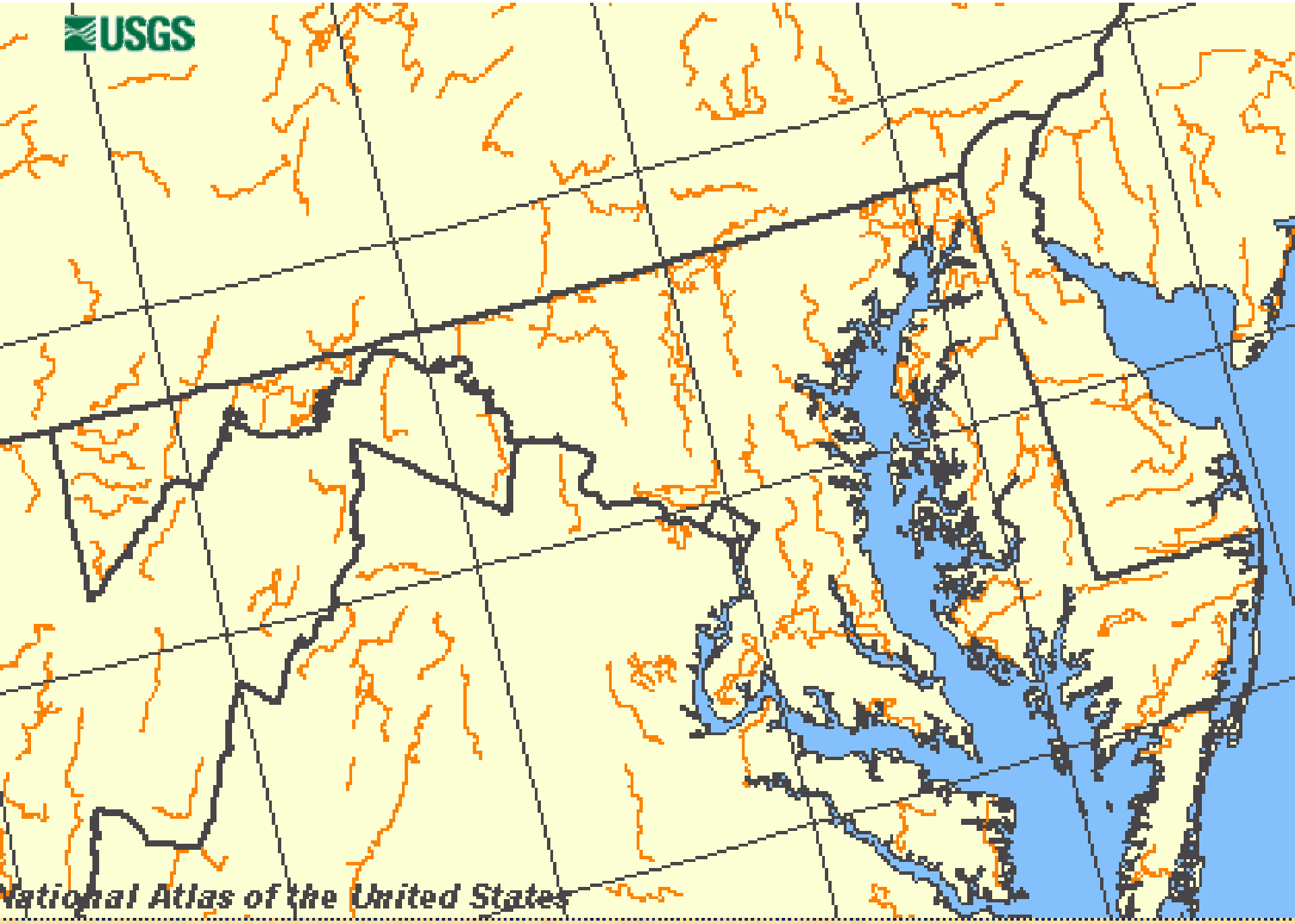
North American Breeding Bird Survey

- Started in 1966
- Roadside survey
  - Conducted in June, 1 survey/route/year
  - 24.5 mi roadside survey “routes” conducted by volunteer observer
  - 50, 3-min point counts along route
- Sum of counts for each species over 50 stops form the index of abundance for the route


Ranger

North American Breeding Bird Survey Route Locations

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National Atlas of the United States

BBS is a Primary Source of Bird Population Data in North America

- >400 species encountered
- Georeferenced (at route level)
- Essential dataset for distribution/change for Cerulean Warblers
- Several important limitations imposed by survey design

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Today

- Discuss available information from the survey
- Describe population change for Cerulean Warblers, as estimated from the BBS
- Discuss value of information

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Statistical Analysis

- Estimate population change at different scales
  - Route level
  - Bird Conservation Region (BCR) scale
  - Range-wide
- Statistical methods
  - Hierarchical models
  - Route-regression method

Estimation of Population Change

$$\log(\lambda_{i,j,t}) = S_i + \beta_i (t - t^*) + \omega_j + \eta\, I(j,t) + \gamma_{i,t} + \varepsilon_{i,j,t}$$

Notation:

;

λ is expected value of Y

Stratum-specific intercept, slope, and year effects (S,β, and γ),

Observer/route effects (ω),

and overdispersion effects (ε)

Observer/route effects, Year Effects, and Overdispersion effects are treated as mean zero normal random variables.

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science for a changing world

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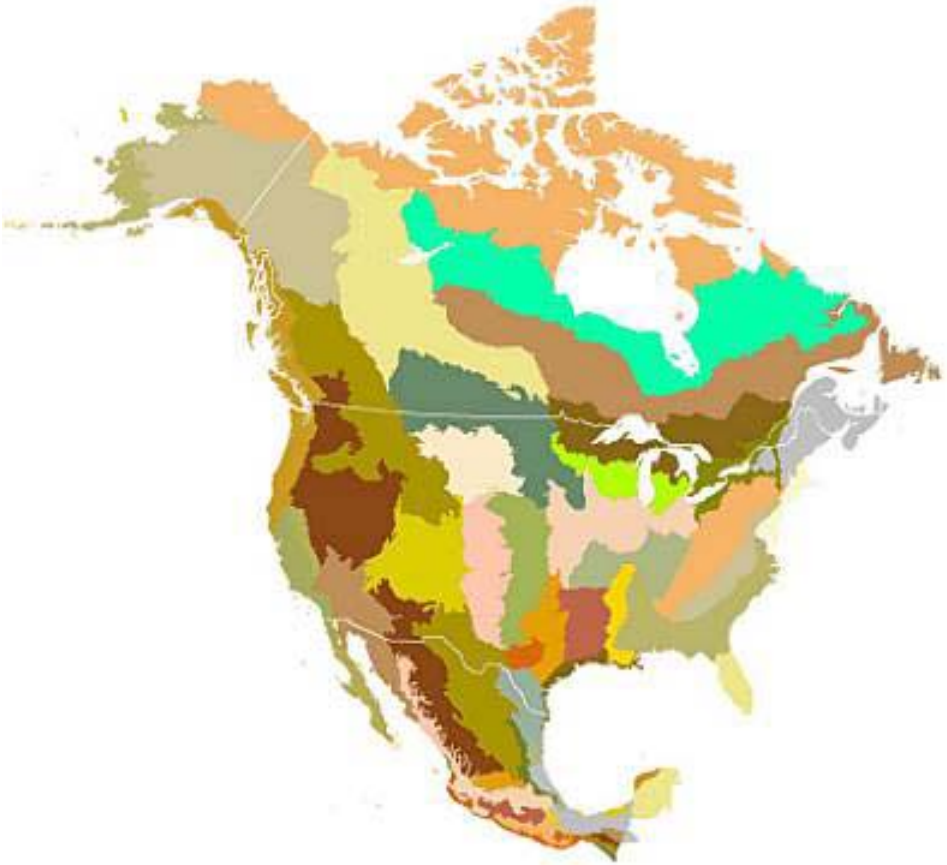
Presentation of Results

- Estimates of population change (%/yr) and Confidence Intervals
  - 10 BCR's, and Survey-wide
- Graphs of population trajectories
- Maps of route-level results
  - Arc view coverages available for additional analysis

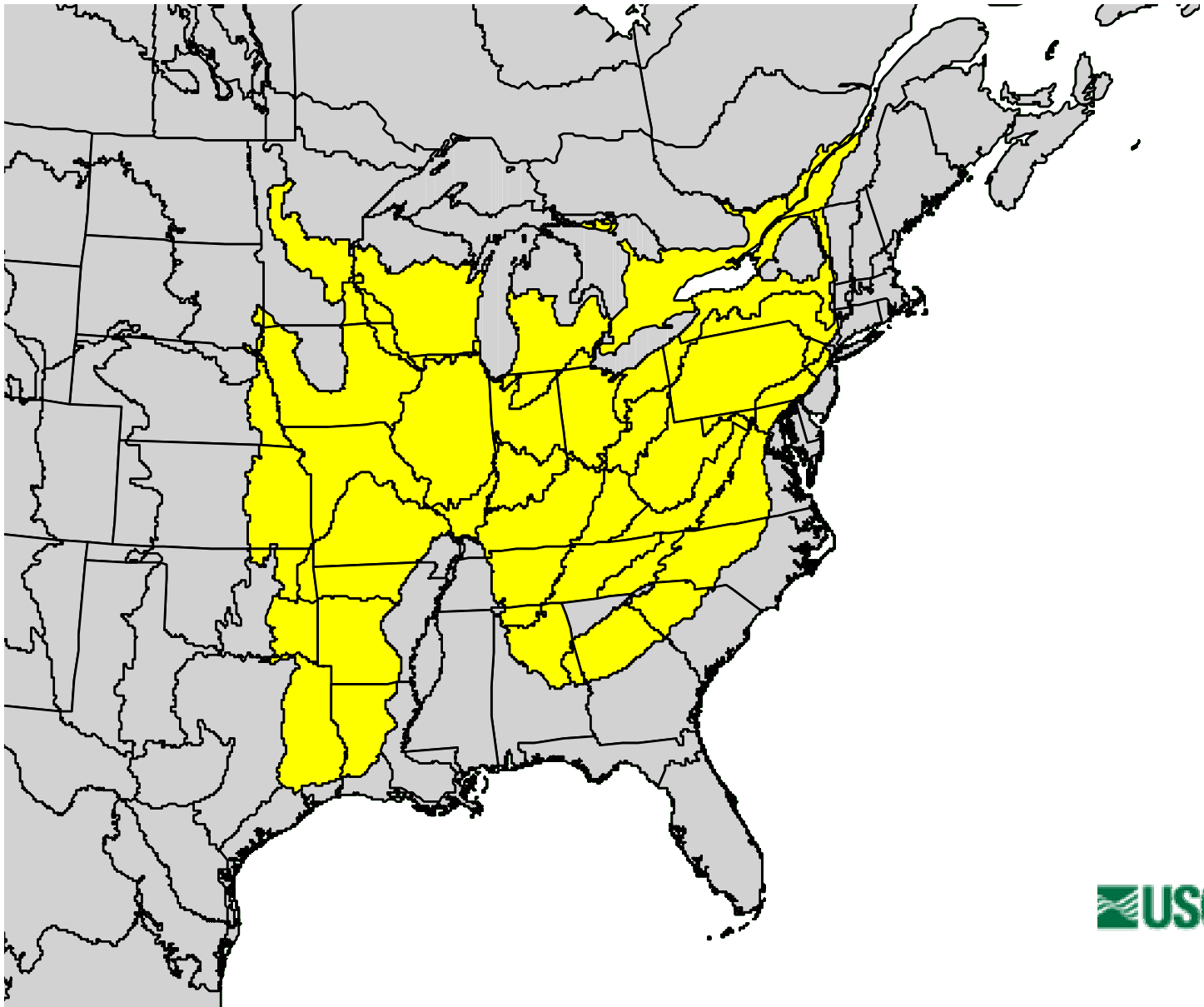
Bird Conservation Regions



Appalachians
Stratum 28

http://www.bsc-eoc.org/international/bcrmain.html

BCR in which Cerulean Warblers Occur



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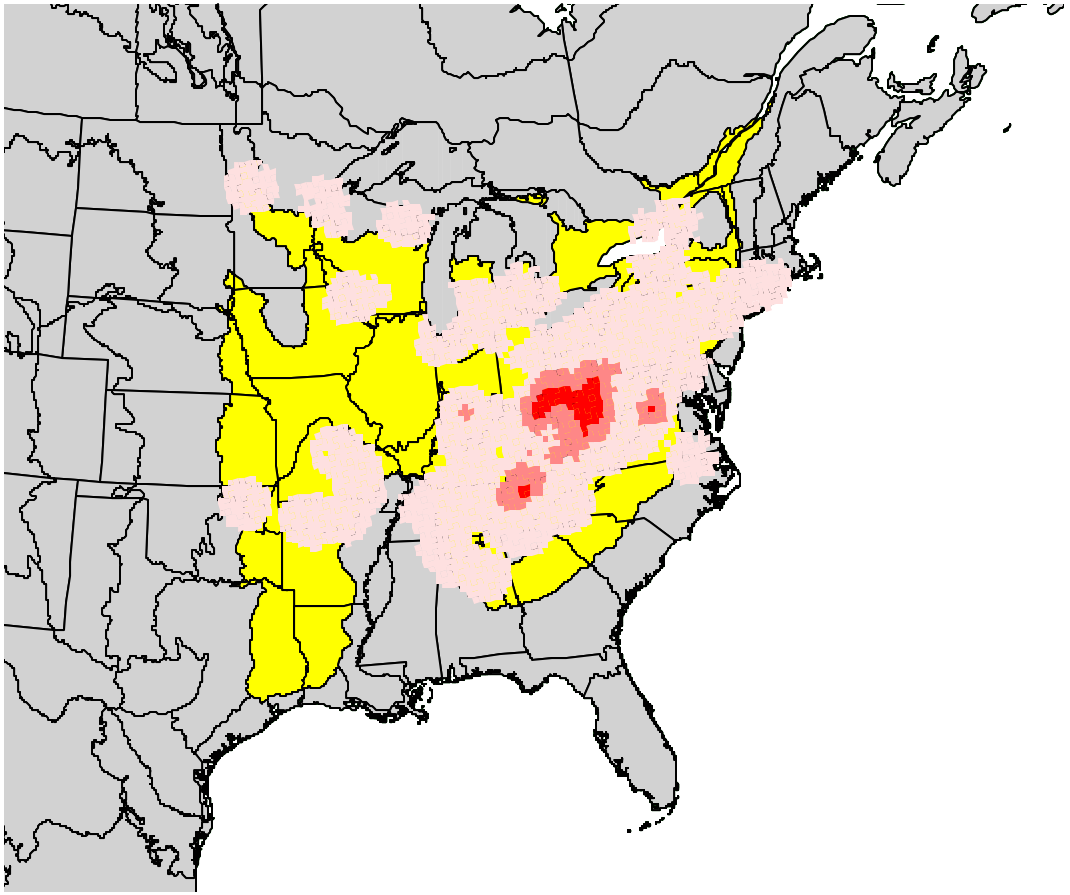
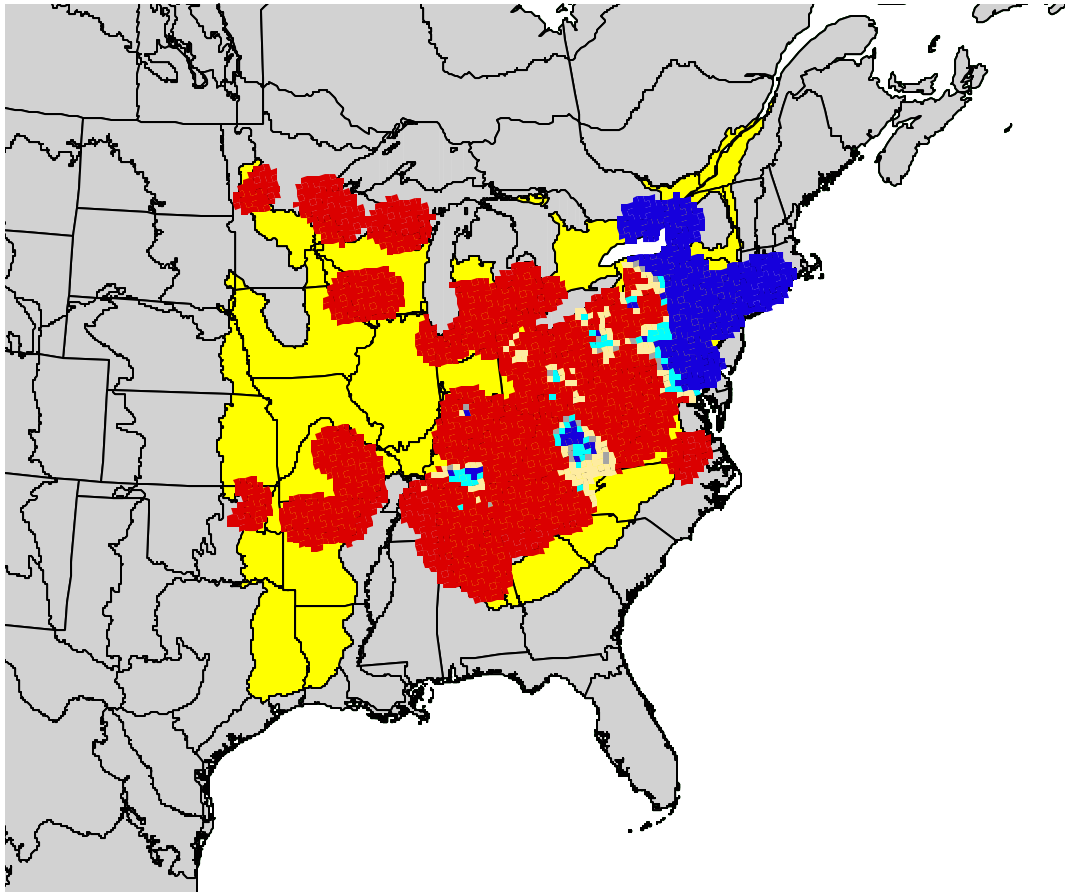
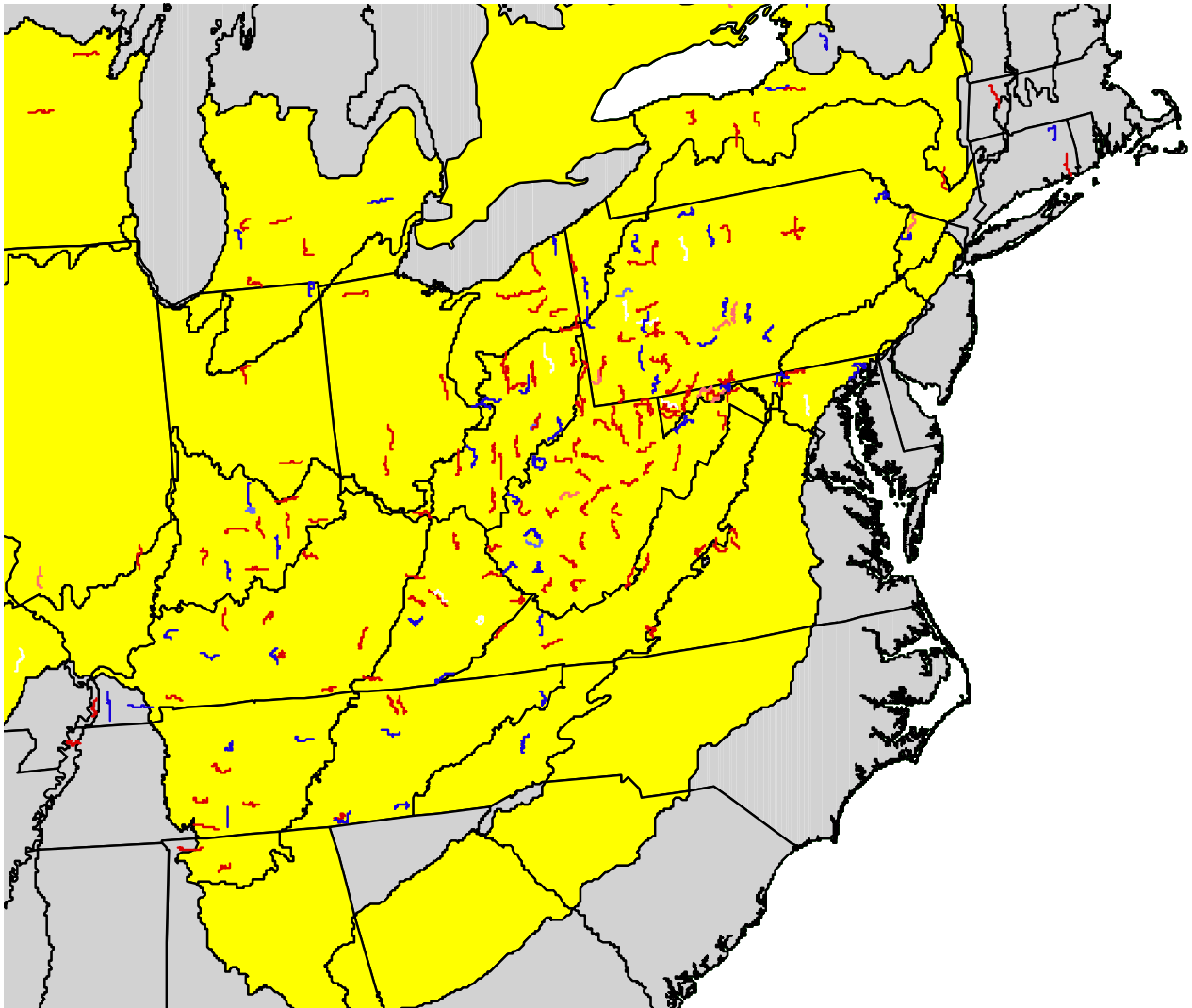
Relative Abundance Map From BBS Data (Means 1992-2001)



Population Change Map From BBS Data (Increase/Decline by Route 1966-2001)



Route Level Data Provide the Most Local Level of Summary



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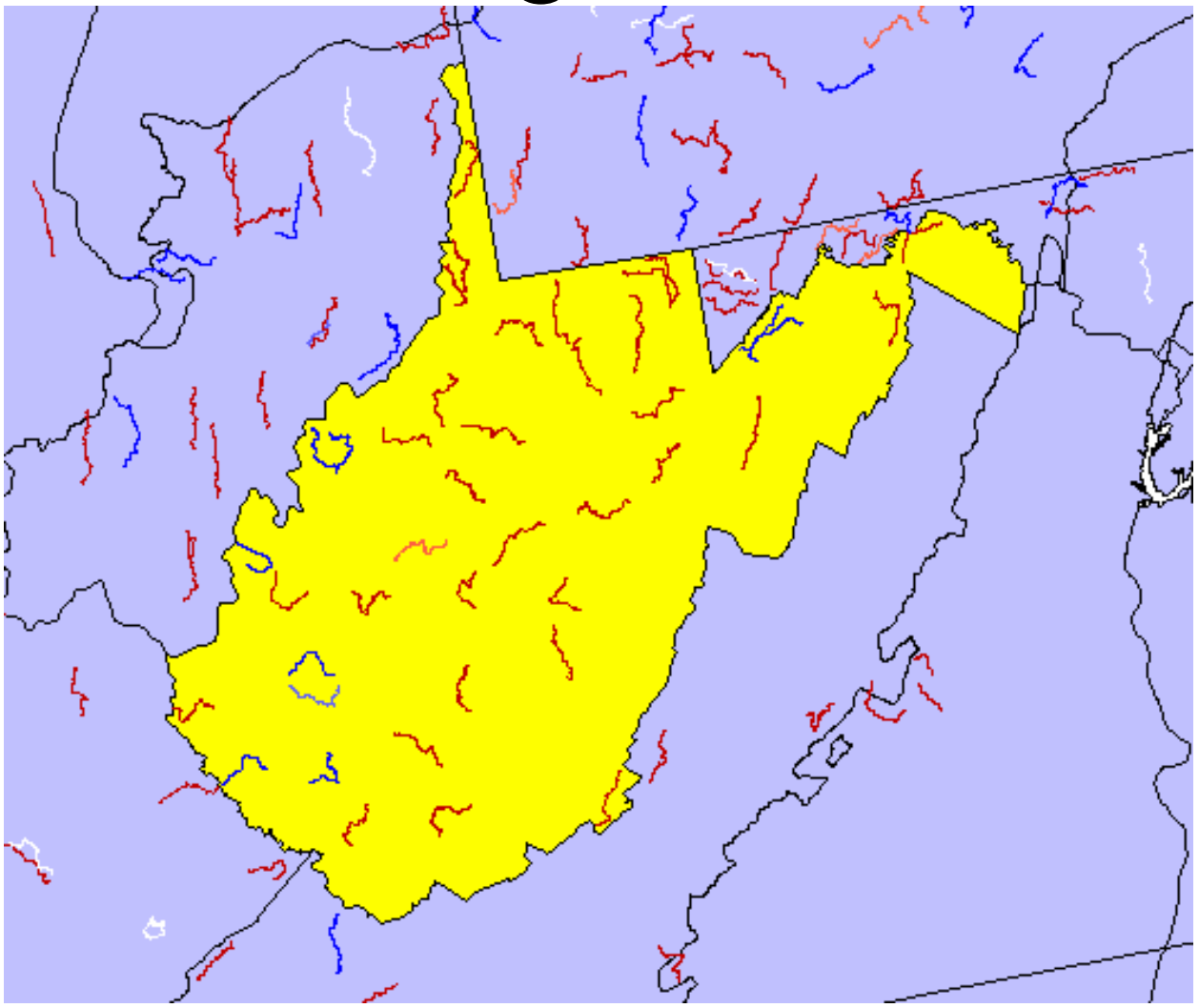
Appalachian Mountains West Virginia



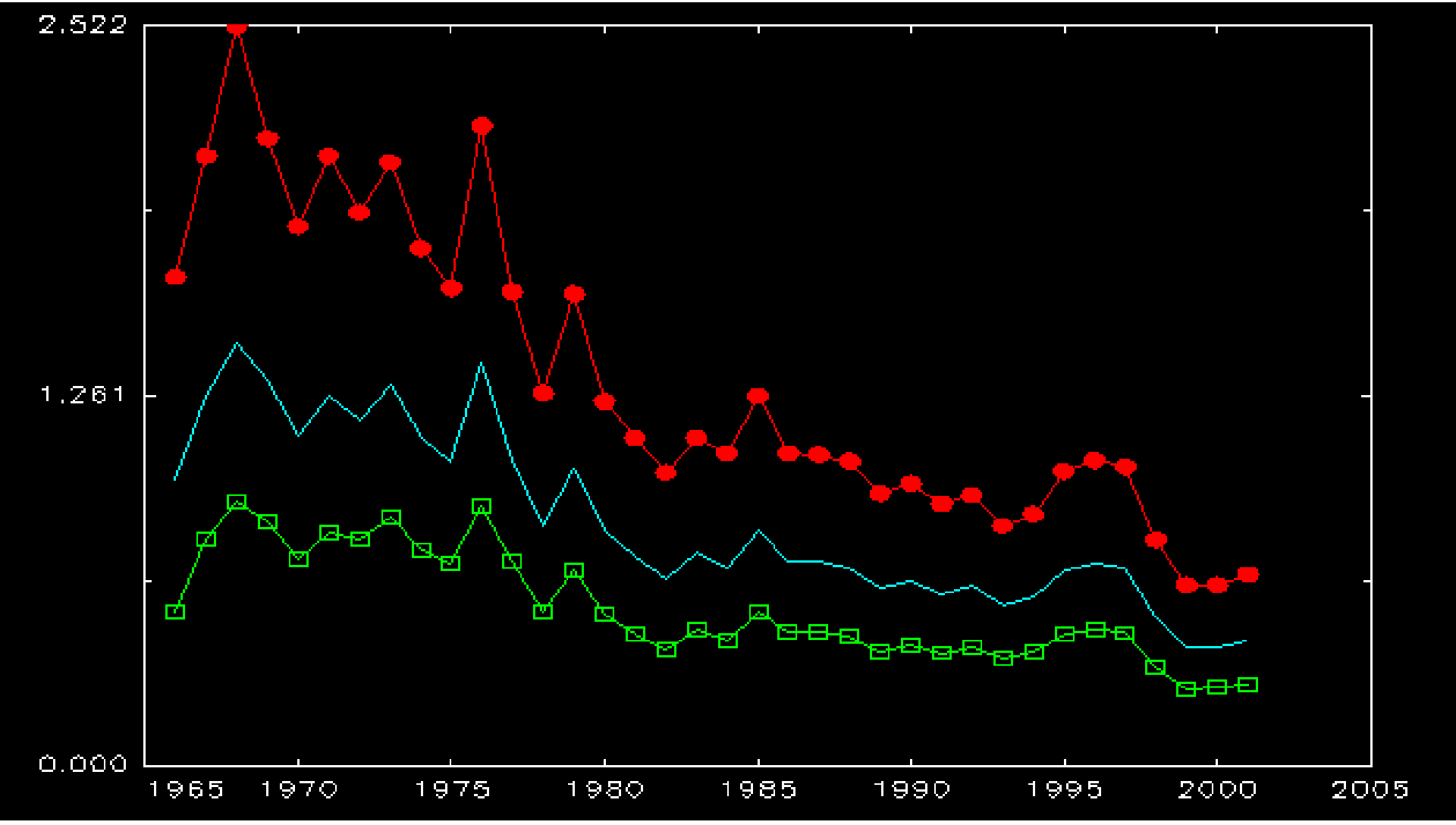
Appalachian Mountains West Virginia

- Hierarchical model

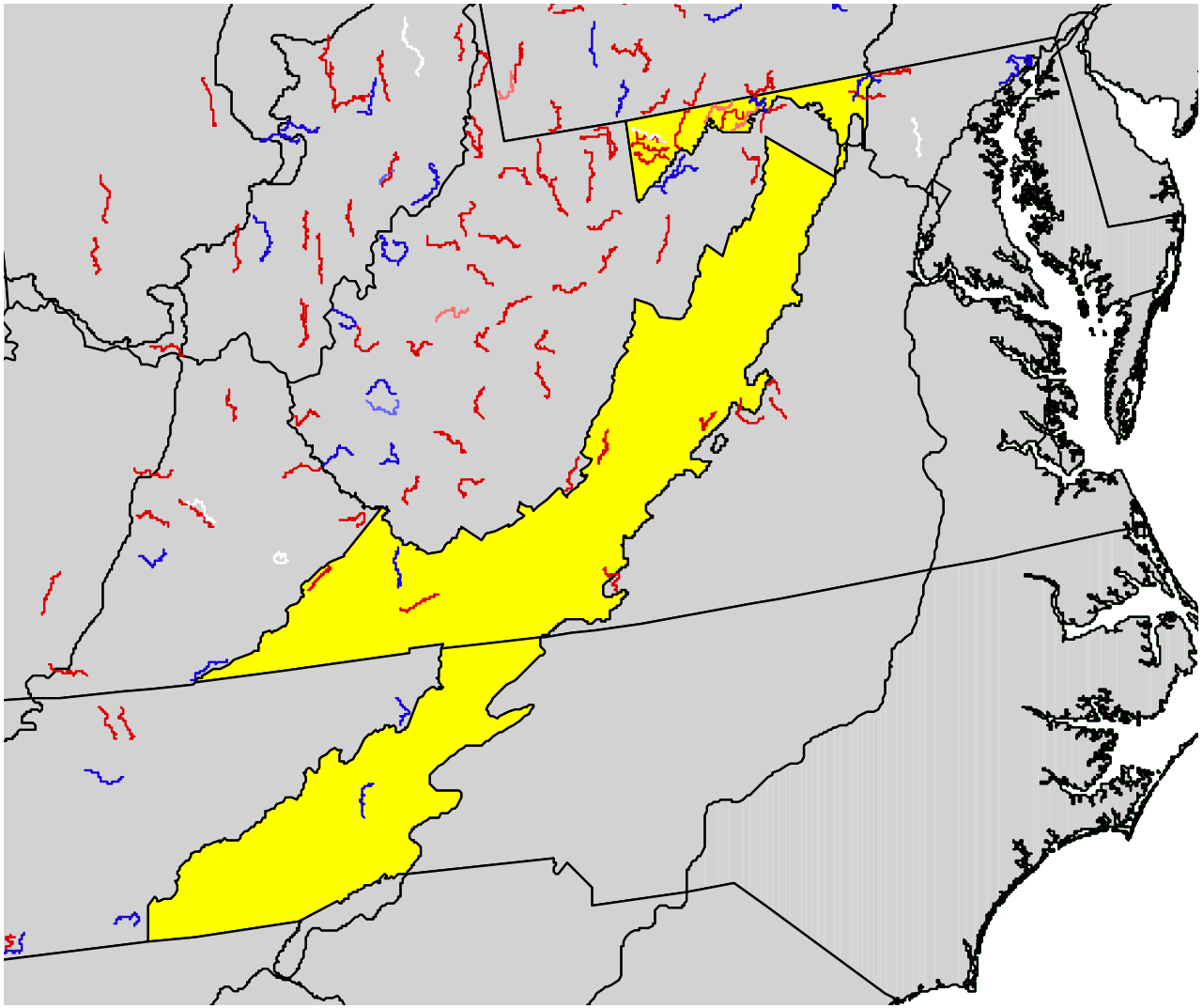
  -3.06 %/yr (-4.44, -1.75)

- Route regression
  - Trend –3.35 %/yr (-4.42, -2.28)
  - 42 Routes
  - Abundance: 2.88 birds/route

Appalachian Mountains West Virginia



Appalachian Mountains East

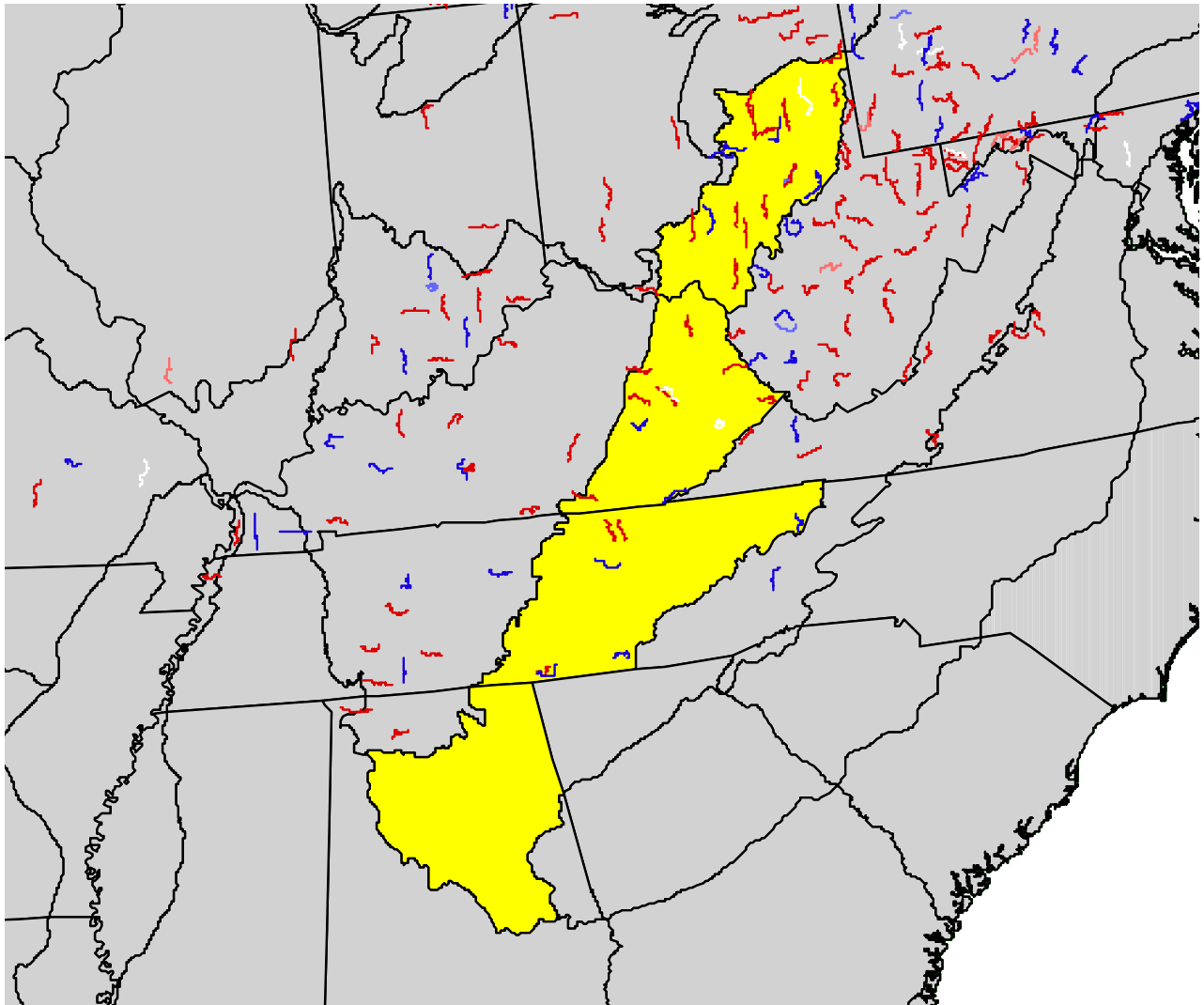


Appalachian Mountains East

- Hierarchical model

  -1.44 (-3.37, 0.50)
- Route regression
  - Trend –1.26 (-3.20, 0.68)
  - 16 Routes
  - Abundance: 0.27

Appalachian Mountains West



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Appalachian Mountains West

- Hierarchical model

  -3.42 (-4.97, -1.82)
- Route regression
  - Trend –3.98 (-5.39, -2.58)
  - 38 Routes
  - Abundance: 1.06

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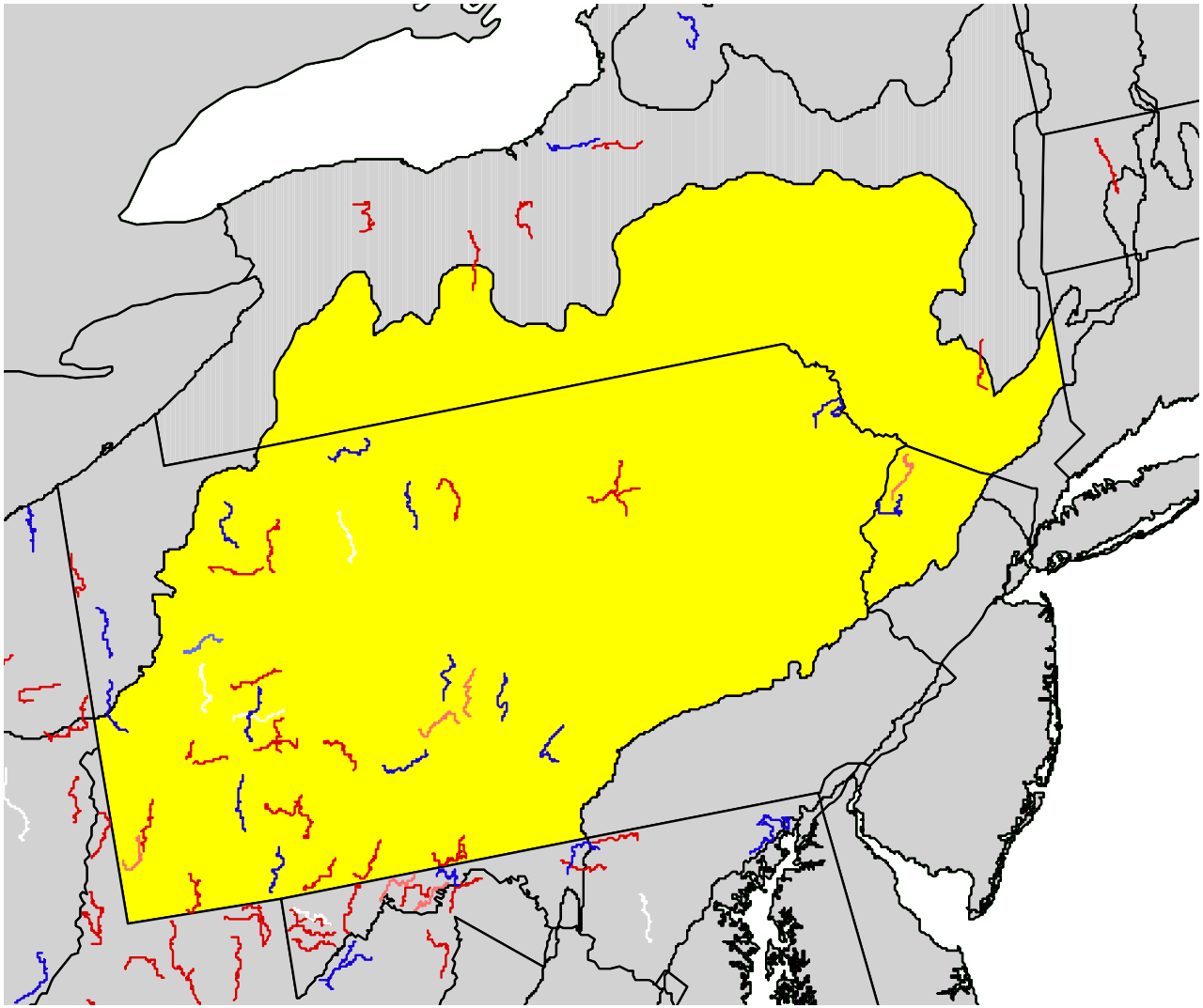
Appalachian Mountains North



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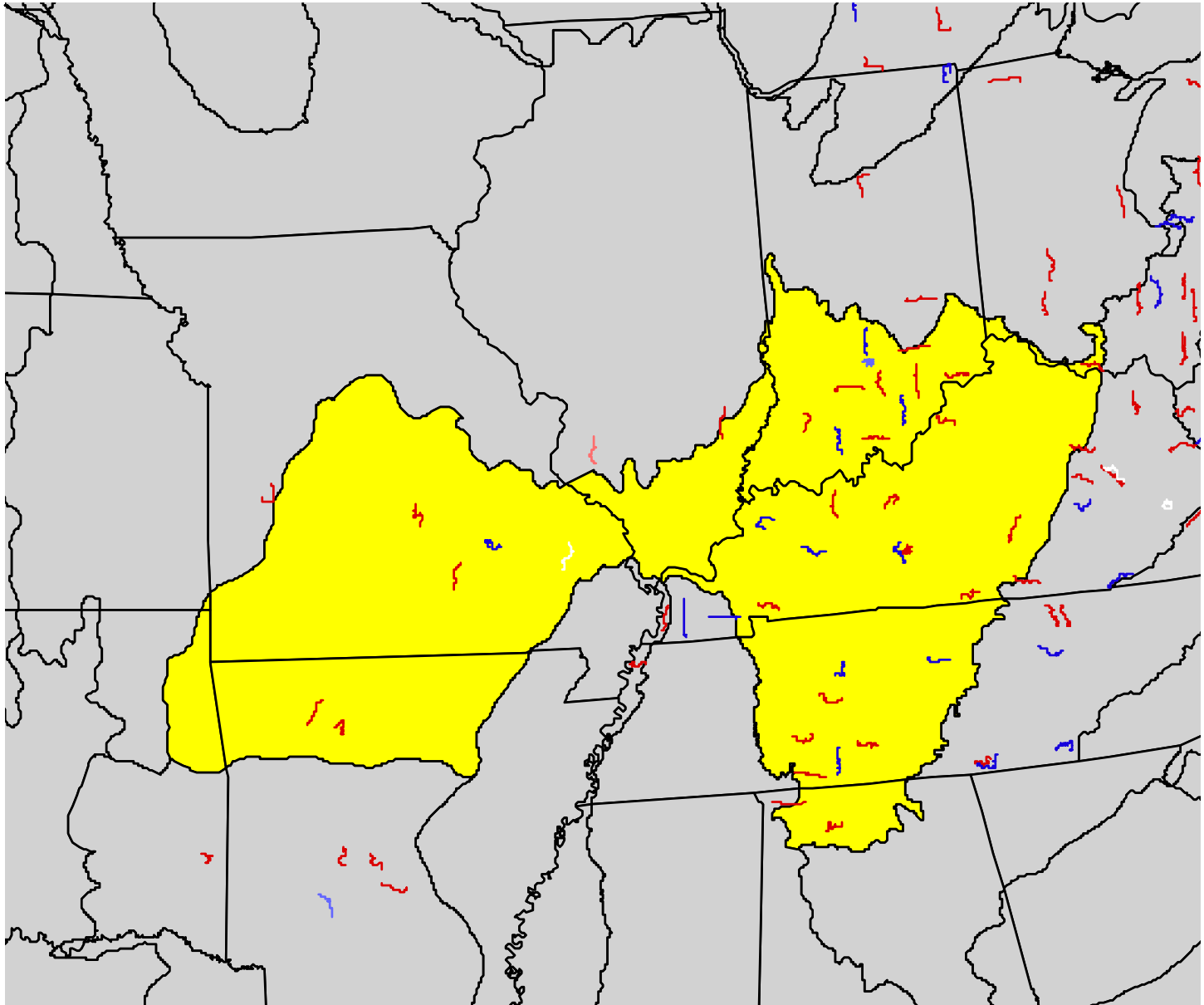
Appalachian Mountains North

- Hierarchical model

  -0.44 (-1.75, 0.90)
- Route regression
  - Trend –1.86 (-3.62, -0.10)
  - 39 Routes
  - Abundance: 0.23

Central Hardwoods



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Central Hardwoods

- Hierarchical model

  -3.95 (-5.37, -2.58)
- Route regression
  - Trend –6.67 (-9.42,-3.92)
  - 34 Routes
  - Abundance: 0.17

Lower Great Lakes/ St. Lawrence Plain

- Hierarchical model

  0.60 (-1.84, 3.10)
- Route regression
  - Trend 0.90 (-5.41, 7.21)
  - 21 Routes
  - Abundance: 0.02

Piedmont

- Hierarchical model

  2.70 (-0.84, 6.30)

- Route regression
  - Trend: -6.95 (-28.86, 15.95)
  - 12 Routes
  - Abundance: 0.01

West Gulf Coastal Plain/ouachitas

- Hierarchical model

  -14.03 (-20.11, -8.26)
- Route regression
  - Trend –15.87 (-23.18, -8.57)
  - 7 Routes
  - Abundance: 0.01

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Eastern Tallgrass Prairie

- Hierarchical model

  -4.68 (-8.90, -0.26)
- Route regression
  - Trend –9.33 (-17.31, -3.05)
  - 9 Routes
  - Abundance: 0.01

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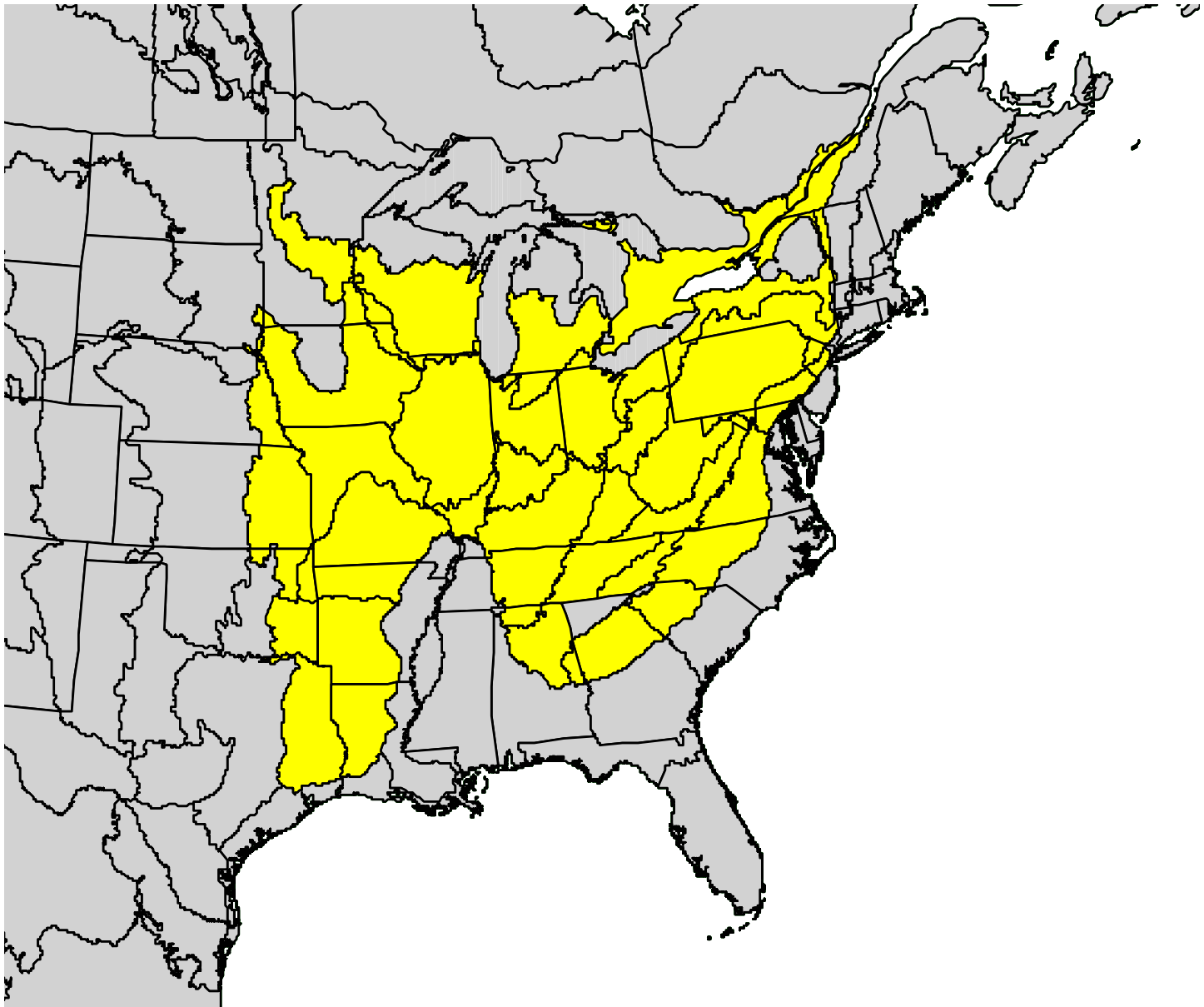
Prairie Hardwood Transition

- Hierarchical model

  -4.48 (-7.20, -1.73)
- Route regression
  - Trend –7.18 (-11.60, -2.77)
  - 14 Routes
  - Abundance: 0.05

Survey-Wide



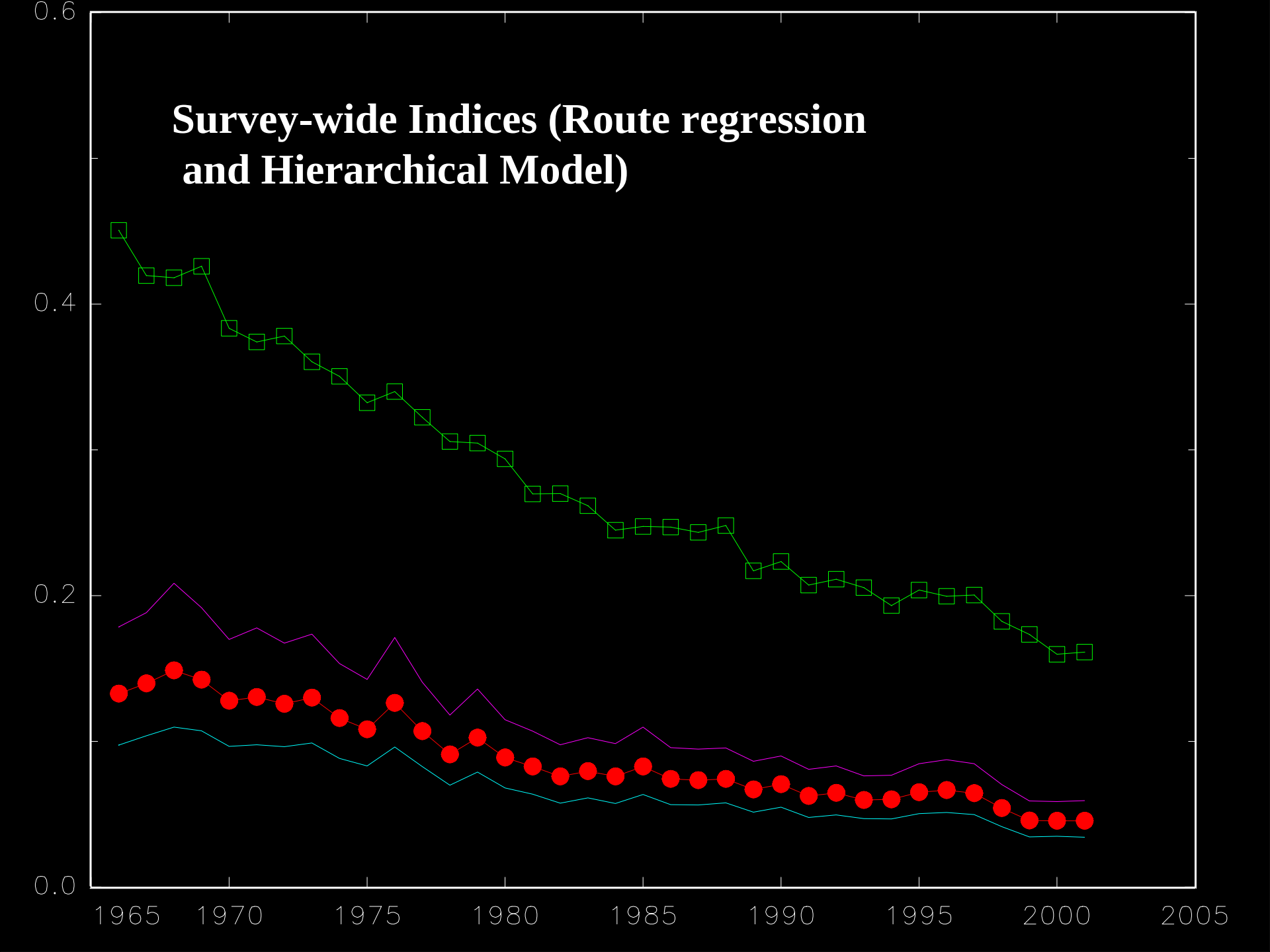
Survey-Wide

- Hierarchical model

  -3.02 (-4.04, -1.99)
- Route regression
  - Trend: –3.53 (-4.71, -2.34)
  - 232 Routes
  - Abundance: 0.27
  - Website:

    Trend:-4.5 (-5.7, -3.2), P = 0.00,

    235 Routes, Abundance: 0.33


Survey-wide Indices (Route regression
and Hierarchical Model)
0.6
0.4
0.2
0.0
1965
1970
1975
1980
1985
1990
1995
2000
2005

BBS has Several Important Limitations

- Point counts do not detect all birds
  - Observers count with varying efficiency
  - Observers have been getting better over time
  - Even the best observers vary in efficiency over time and space
- Roadsides do not reflect the entire landscape
  - Habitats tend to differ
  - Rate of change of habitats differs along roads

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Analysis Accommodates Some (But Not All) Deficiencies

- Observer differences accommodated
- Relative abundance is arbitrary
  - Different methods can scale abundances to different levels
- On vs Off road issues cannot be addressed directly. Solutions include:
  - Models (evaluate differences in habitat)
  - Experimental studies (count off roads)